Homoptera Coccoidea of New Caledonia. A revision of the Monophlebulini with a redefinition of the genus *Tessarobelus* Montrouzier (Margarodidae Monophlebinae)

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ABSTRACT

The monotypic genus *Tessarobelus* Montrouzier is redefined here to include four new species : *T. immaturus*, *T. inusitatus*, *T. ordinarius* and *T. perissoporosus* as well as the type species *T. guerini*. A neotype of *T. guerini* is designated. A new genus, *Insulococcus*, is erected for a new species, *I. magnoporus*, from New Caledonia and the Loyalty Islands. A key to the genus *Tessarobelus* is provided, and adult females of all species are described.

RÉSUMÉ

Le genre monotypique *Tessarobelus* Montrouzier a été redéfini *ici* pour inclure quatre espèces nouvelles *T. immaturus*, *T. inusitatus*, *T. ordinarius* et *T. perissoporosus* aussi bien que l'espèce-type, *T. guerini*. Un néotype est désigné pour *T. guerini*. Un genre nouveau, *Insulococcus*, est érigé pour une espece nouvelle, *I. magnoporus*, des Iles Loyauté et de Nouvelle-Calédonie. La clef du genre *Tessarobelus* est donnée ainsi que les descriptions des femelles adultes de toutes les espèces.

BHATTI, S., 1991. – Homoptera Coccoidea of New Caledonia. A revision of the Monophlebulini with a redefinition of the genus *Tessarobelus* Montrouzier (Margarodidae Monophlebinae). *In* : J. CHAZEAU & S. TILLIER (eds), Zoologia Neocaledonica. Volume 2. *Mem. Mus. natn. Hist. nat.*, (A), **149** : 131-149. Paris ISBN : 2-85653-179-2.

Publié le 20 février 1991.

The tribe Monophlebulini (Margarodidae : Monophlebinae) is known from Australia, New Guinea and New Caledonia but has not been reported from New Zealand. Genera of this tribe in New Guinea (Bhatti & Gullan, 1990) and New Caledonia have strong affinities with those in Australia although all faunas exhibit a high degree of generic endemism. Only one monophlebuline genus, *Monophlebulus* Cockerell, occurs in both Australia and New Guinea. Both the New Caledonian and New Guinean species have greater resemblance to the Australian species than to each other.

New Caledonia and New Zealand have been separated from Gondwana since at least the Late Cretaceous (Holloway, 1979 ; Briggs, 1987). New Caledonia has persisted as a large landmass from the end of the Eocene and was probably extensively subaerial prior to that, at least from the Late Cretaceous (Holloway, 1979). The relationship of New Caledonia to other landmasses and the potential access routes for its flora and fauna have been well-documented by Holloway (1979). Although evidence from Triassic rocks and fossils suggest geological affinities of New Caledonia with New Zealand and not eastern Australia (Fleming, 1975), there is no evidence that New Caledonia and New Zealand were any closer in the past than at present. Australia and New Caledonia may have had direct land connections via the Chesterfield Plateau and the Lord Howe Rise during the general uplift of these regions in the Late Miocene followed by the lowering of sea levels during the Late Pleistocene (Holloway, 1979 ; Keast, 1981), thereby facilitating the exchange of organisms via this route (Holloway, 1979). The Loyalty Islands are very recent in origin and the current uplift of these islands commenced only in the Lower Pleistocene (Holloway, 1979) ; they were probably colonised by dispersal from their neighbour New Caledonia.

Until the present study, the New Caledonian Monophlebulini were represented by a single species, *Tessarobelus guerini* Montrouzier. This genus was first described by Montrouzier (*in* Perroud & Montrouzier, 1864) for male and female specimens from New Caledonia. The male and the female were identified as the same species on the basis of similar collection data. The type material of *T. guerini* Montrouzier has apparently heen lost (Miller, 1971). Montrouzier did not place his new genus in any higher taxon but recognised the affinities of the female with that of the genus *Callipappus* Guérin (Margarodidae : Margarodinae : Callipappini), at the same time clearly distinguishing the male and female of his new species from those of the latter. Morrison (1928) tentatively placed the genus *Tessarobelus* in the tribe Monophlebulini without actually describing the genus. The true status of the genus was confirmed by Miller (1971) who redescribed *T. guerini* from female specimens collected in New Caledonia, one of which, a third instar female, was collected on the same host (*Melaleuca* L.) as Montrouzier's type specimens (*vide* Signoret, 1876). Miller (1971 : 67) described *T. guerini* as ' the only monophlebine margarodid known from New Caledonia where it is widely dispersed and relatively common '.

A detailed examination of specimens collected from New Caledonia and located in various museums has now revealed that the islands are inhabited by at least six species of monophlebine margarodids. It is possible that Miller's species may not be *T. guerini* (D. R. Miller, pers. comm.). Montrouzier's original description is inadequate for identification because it was based entirely on the external appearance of the insects without any microscopic details of the cuticle of the female and all the species described here are similar in external appearance. Details of the type locality are obscure and only an immature female specimen collected on the type host-plant is known ; it is difficult to associate an adult female with the third instar female of a species. However, to avoid further taxonomic confusion as to the validity of the type of the genus *Tessarobelus* and to bring nomenclatural stability for other species included in the genus, a neotype from specimens used by Miller for the description of *T. guerini* is designated.

This paper reports five new species of monophlebine margarodids, based on adult females, from New Caledonia and the Loyalty Islands. A neotype of *T. guerini* is designated and *T. immaturus*, *T. inusitatus*, *T. ordinarius* and *T. perissoporosus* are described as new. A key to the genus *Tessarobelus* is provided. A new genus, *Insulococcus*, is erected for a new species, *I. magnoporus*, from New Caledonia and the Loyalty Islands.

Materials and Methods

This study is based upon material in the museums listed below. The available specimens were either on microscope slides or preserved in alcohol. The alcohol-preserved specimens were mounted on microscope slides using Gullan's (1984) method of preparation of coccoids. The species descriptions are based on all of the material examined, except where otherwise stated. In all the illustrations, structures located marginally on the specimens are drawn ventrally and marginally, those located submarginally are drawn inner to the margin, and those referred to as intermediate in position are drawn between the medial and submarginal regions.

The following abbreviations are used for depositories :

ANIC : Australian National Insect Collection, Canberra. BMNH : British Museum (Natural History), London. BPBM : Bernice P. Bishop Museum, Hawaii. MNHN : Muséum national d'Histoire naturelle, Paris. USNM : United States National Museum of Natural History, Washington.

Phylogeny and discussion of characters

The genus *Tessarobelus* appears to be monophyletic despite the variability in many of the characters discussed below. It may be separated from other genera of the Monophlebulini (Bhatti, 1990 ; Bhatti & Gullan, 1990) by having abdominal spiracles with atrial length about twice the width and numerous (4-10 rows) multilocular pores inside the atrium. Robust spiniform setae occur in all five species and, although not unique to this group (Bhatti, 1989), the spiniform setae of *Tessarobelus* are very short in four of the five species, *T. guerini*, *T. inmaturus*, *T. inusitatus* and *T. ordinarius*, in comparison with other monophlebuline genera. Although the distribution of cicatrices is not uniform within *Tessarobelus*, all five species possess transverse rows of cicatrices on the abdomen. The monophyly of the group may further be confirmed through knowledge of the first instar nymphs which, unfortunately, are unknown for any of the above species (see notes for *T. guerini*).

It is pertinent to erect a new genus for the new species, *I. magnoporus*, from New Caledonia and the Loyalty Islands, since the placement of this species in any of the existing genera is unjustifiable. The structure of the dorsal and ventral multilocular pores, except those around the genital opening, and the distribution of the abdominal cicatrices are unique to this species. The distribution of abdominal cicatrices is very different to that observed in *Tessarobelus*. *I. magnoporus* is similar to species in the genus *Monophlebulus* with respect to the structure of the spiracles and the distribution of the flagellate setae. However, its inclusion in either *Monophlebulus* or *Tessarobelus* would require a redefinition of one of these two genera since *I. magnoporus* does not possess any of the diagnostic characters of *Tessarobelus* and few of those of *Monophlebulus*.

The New Caledonian species resemble the other Monophlebulini (Bhatti, 1990 ; Bhatti & Gullan, 1990) in segmentation, location of spiracles and genital and anal openings, and structure and distribution of pores and setae except for the few features discussed below.

Anal tube. All species of *Tessarobelus* have a band of multilocular pores and spines present between the middle and external opening of the anal tube in addition to the distal band of polygonal pores, except *T. guerini* and *T. inusitatus* in which only the distal band of polygonal pores is present and the anal tube resembles that observed in the genus *Nodulicoccus* Morrison (Morrison & Morisson, 1923).

Antennae. The number of antennal segments in the adult females of *Tessarobelus* varies from 3 in one species to 7-9 in others. The 3 segmented antenna of the adult female is comparable with that of the second instar nymph of the genera

Monophlebulus, *Nodulicoccus*, *Melaleucococcus* Bhatti and *Peengea* Bhatti & Gullan, where the basal 2 segments are distinct and the third or the apical segment is elongate and composed of a number of fused segments. The second instar nymph is unknown for the other genera of Monophlebulini.

Cicatrices. The distribution of cicatrices is usually diagnostic of a genus in the tribe Monophlebulini and does not vary much between species. In the New Caledonian species the distribution of cicatrices is somewhat variable within the genus *Tessarobelus*. All the New Caledonian species lack cicatrices on the head and thorax except *T. guerini*. The cicatrices are usually present in single rows on the abdominal segments except in *T. perissoporosus* where narrow bands are observed on the posterior abdominal segments. Hence, the distribution of cicatrices alone is not a useful generic character as far as the genus *Tessarobelus* is concerned. *I. magnoporus* has cicatrices present only on the abdomen in short rows intermediate in position on segments VI-IX.

Pores. Four types of pores have been observed in the New Caledonian species. The structure of the multilocular pores, multilocular tubular pores and trilocular tubular pores is the same as in the other Monophlebulini (Bhatti, 1989). In addition, *T. immaturus* has multilocular pores with 2-10 or more circular central loculi and many (more than 20) small peripheral loculi. In *I. magnoporus* the peripheral loculi are larger and somewhat triangular in shape as opposed to the smaller elliptical peripheral loculi usually present in the other Monophlebulini. Trilocular tubular pores, tetralocular tubular pores and pentalocular tubular pores are present only in one New Caledonian species ; the latter two types are absent from the New Guinean Monophlebulini and are rarely observed in the Australian Monophlebulini. The tubular pores in some of the New Caledonian species differ from similar pores in other Monophlebulini in being not so deeply invaginated or less tubular. Simple micropores, 3.8-8.8 µm in diameter, are present dorsally and ventrally in the adult female of all the species described here. In the New Guinean Monophlebulini they are relatively uncommon and difficult to see even on stained specimens, whereas in the genus *Tessarobelus* they are relatively common and very distinct in deeply stained specimens. These simple micropores are much more numerous, both dorsally and ventrally, in *T. perissoporosus* than in other species within the genus. The distribution of the simple micropores ranges from being relatively common in some Australian genera to being very rare in the other genera (Bhatti, 1989).

Setae. Both flagellate and hair-like setae are present in the New Caledonian species. Sometimes the hair-like setae tend to have a very robust apical half and have the appearance of spiniform setae with sockets. The spiniform setae are heavily sclerotised and are very robust. In one species the spiniform setae in the intersegmental regions are extremely robust and tend to be finger-like in appearance with somewhat parallel sides and a blunt apex. Subulate setae, similar to those present in *Modicicoccus* Bhatti & Gullan and *Monophlebulus*, are present in some species of *Tessarobelus*. Nodulate setae, similar to those found in *Nodulicoccus*, occur only in *T. guerini*. Clavate setae, similar to those present in the first instar nymphs of *Melaleucococcus* (Bhatti, 1990) occur in *T. inusitatus*.

Spiracles. The abdominal and thoracic spiracles in *Tessarobelus* are very distinctive in that the atria are large, heavily sclerotised and with multilocular pores. The atrial length of abdominal spiracles may be more than twice their width and about 4-10 rows of multilocular pores may be present inside the atrium.

Genus *TESSAROBELUS* Montrouzier

Tessarobelus Montrouzier, 1864, *Ann. Soc. Linn. Lyon*, **11** : 246-247 (type species *Tessarobelus guerini* Montrouzier, by monotypy and original designation).

Generic description of adult female : slide-mounted specimens elongate, elliptical, 5.2-18.7 mm long, 2.8-10.1 mm wide, broadened posteriorly. Antenna 3 or 7-9 segmented, basal segment largest, apical and sometimes third elongate ; hair-like setae present, number per segment variable. Eye spots circular to triangular, near antennal bases. Labium conical, 3 segmented : basal segment ring-like represented by a narrow sclerotised band ; medial segment broadest ; apical segment conical. Legs : each trochanter with usually 4-5 translucent pustules on each face ; tarsal claw with 1 pair of apically acute digitules shorter than claw length. Thoracic

and abdominal spiracles with multilocular pores in atrium. Dorsal anal tube short distance from apex of abdomen, with a sclerotised band of polygonal pores internally distal to external opening, and usually a ring of multilocular pores and short spines inside tube either near middle or between middle and external opening. Cicatrices circular to slightly elliptical, 18-62 μm long, 16-55 μm wide, on venter only, in transverse rows medially on abdominal segments I-V or II-VII or III-VI (sometimes cicatrices present on segments I-II) and rows following lines of segmentation on abdominal segments VI-IX or VII-IX, and in one species, also present in medial cluster on head and thorax.

Dorsum. Clavate setae either absent or, if present, 18-19 μm long, few on derm around anal opening on abdominal segments VII-IX. Nodulate setae either absent or, if present, 11 μm long, rare, scattered over entire surface. Subulate setae either absent or, if present, 43 μm long, few, scattered over entire surface. Spiniform setae, 23-86 μm long, numerous scattered over entire surface, predominant setal type. Flagellate setae, 19-73 μm long, few to very rare, scattered over entire surface. Hair-like setae, 48-169 μm long, few, scattered over entire surface. Multilocular pores, variable in structure, scattered over entire surface. Multilocular tubular pores either absent or, if present, in transverse bands across medial regions of each body segment and absent on derm around anal opening medially on segments VII-IX. Trilocular and tetralocular tubular pores either absent or, if present, in segmental bands over entire surface.

Venter. Clavate setae either absent or, if present, 20-27 μm long, scattered submarginally on derm lateral to each thoracic spiracle. Nodulate setae either absent or, if present, 10-12 μm long, few, scattered over abdomen. Subulate setae either absent or, if present, 36-48 μm long, few usually scattered over entire surface, and many in marginal segmental region either scattered or in clusters associated with clusters of trilocular and tetralocular tubular pores. Spiniform setae, 17-106 μm long, numerous scattered over entire surface, predominant setal type. Flagellate setae, 23-69 μm long, few scattered over entire surface, sometimes numerous on derm around genital opening. Hair-like setae, 81-173 μm long, few, scattered over entire surface. Multilocular pores, variable in structure, scattered over entire surface. Multilocular tubular pores, in broad bands across medial areas of abdominal segments I-V or III-VI and submarginally on abdominal segments II-IX or IV (or VI) -IX, usually absent on head and thorax. Trilocular and tetralocular tubular pores absent or, if present, in marginal clusters.

Key to the species of *Tessarobelus* (adult females)

1. Ventral cicatrices present in medial clusters on head and thorax, and in transverse rows on abdominal segments; nodulate setae present; clavate setae absent; multilocular pores and spines absent from anal tube; subulate setae present on venter, absent on dorsum; antenna 8 segmented; trilocular and tetralocular tubular pores absent ..... ***guerini*** Montrouzier

— Ventral cicatrices absent on head and thorax, present in tranverse rows on abdominal segments; nodulate setae absent; clavate setae absent or present; spines and multilocular pores usually present inside anal tube; subulate setae either absent or, if present, on both dorsum and venter; antenna 3 segmented or 7-9 segmented; trilocular and tetralocular tubular pores absent or present 2

2. Ventral cicatrices usually in single rows on anterior abdominal segments I-II and in bands on posterior abdominal segments III-IX; trilocular and tetralocular tubular pores present in marginal segmental

clusters ; clavate setae absent ; subulate setae present ; antenna 9 segmented ; derm densely porose ..... ***perissoporosus*** n. sp.

Ventral cicatrices usually in single rows, never in bands on abdominal segments ; trilocular and tetralocular tubular pores absent ; clavate setae absent or present ; subulate setae absent ; antenna 3 or 7-segmented ; derm not densely porose 3

3. Antenna 3 segmented : multilocular pores with about 20 peripheral loculi present on dorsum and venter ; heavily sclerotised robust spiniform setae with a blunt apex present marginally and in intersegmental regions on dorsum and venter, numerous scattered submarginally on head and thorax ; clavate setae absent ..... ***immaturus*** n. sp.

Antenna 7-8 segmented ; multilocular pores with about 20 peripheral loculi absent ; heavily sclerotised robust spiniform setae with a blunt apex absent ; clavate setae absent or present 4

4. Clavate setae present ; multilocular tubular pores present in segmental bands over almost entire dorsum and venter ; a dense ring of long hair-like setae present on derm around anal opening ; spines and multilocular pores absent from anal tube ..... ***inusitatus*** n. sp.

Clavate setae absent ; multilocular tubular pores present ventrally on abdomen, absent on dorsum ; a dense ring of long hair-like setae absent on derm around anal opening ; spines and multilocular pores present inside anal tube ..... ***ordinarius*** n. sp.

Tessarobelus guerini Montrouzier

(fig. 1)

PERROUD & MONTROUZIER, 1864 : 246-247 ; MILLER, 1971 : 66-67.

Description of adult female (based on 8 ♀) : slide-mounted specimens elongate, elliptical, 10.0-18.7 mm long, 5.4-10.1 mm wide. Antenna 8 segmented (in most specimens segments 3-8 are not clearly demarcated by desclerotised regions between segments, but regions of heavy sclerotisation indicating segments and marginal indentations of the antenna are distinct in some specimens), 1425-1790 μm long ; third segment 255-280 μm long ; apical segment elongate 215-260 μm long, 125-145 μm wide. Eyes of maximum diameter 180-205 μm. Clypeolabral shield 1010-1070 μm long. Labium 430-660 μm long. Hind legs 3405-4560 μm long. Mesothoracic spiracles plus peritremes 340-425 μm long, 245-315 μm wide ; metathoracic spiracles plus peritremes 350-430 μm long, 260-350 μm wide. Atrium of abdominal spiracles 75-109 μm wide. Multilocular pores present in atrium of abdominal and thoracic spiracles : each pore with an elliptical central loculus and about 14 peripheral loculi. Anal tube 180-200 μm long ; inner sclerotised ring of polygonal pores 200-205 μm wide. Ventral cicatrices 18-32 μm long, 16-29 μm wide, in medial clusters on head and thorax, in transverse rows medially on abdominal segments I-V, and in rows of segmentation on abdominal segments VI-IX, absent medially on segments VI-IX.

Dorsum. Clavate setae absent. Nodulate setae, 11 μm long, rare, scattered over entire surface. Subulate setae absent. Spiniform setae, 25-35 μm long, numerous, scattered over entire surface, dense on derm around anal opening, predominant setal type. Flagellate setae, 52-72 μm long, few scattered over entire surface. Hair-like setae, 64-121 μm long, few, scattered. Multilocular pores, 8-10 μm in diameter, with 3 circular central loculi and 3 elliptical peripherical loculi, numerous, scattered over entire surface ; pores with 4 circular central loculi and 4 elliptical peripheral loculi, very rare ; pores with an elliptical central loculus and 6-8 elliptical peripheral loculi numerous on derm around anal opening.

Venter. Clavate setae absent. Nodulate setae, 10-12 μm long, few, scattered over abdomen, more numerous submarginally. Subulate setae,

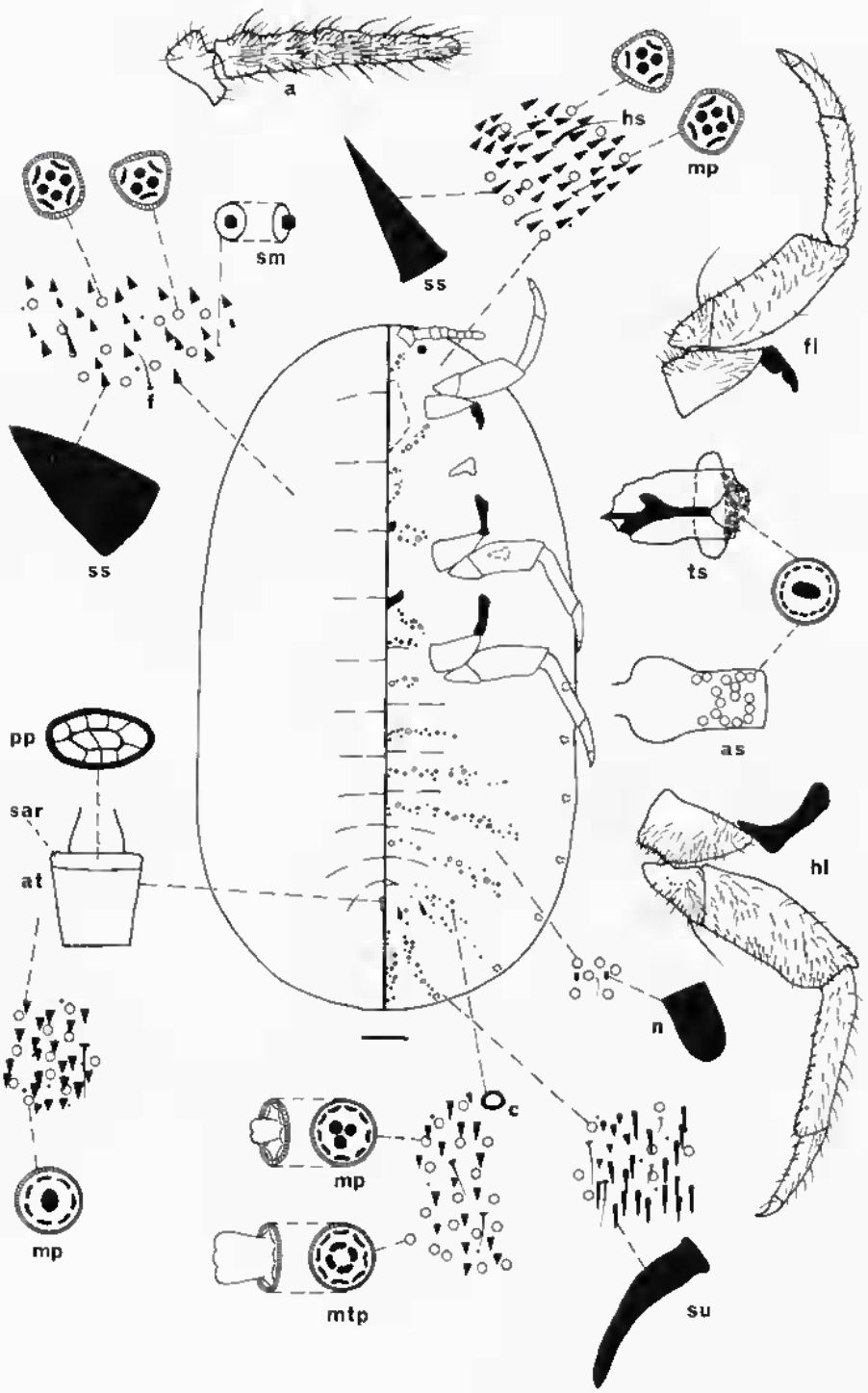

FIG. 1. Adult female of *Tessarobelus guerini*. *a*, antenna ; *as*, abdominal spiracle ; *at*, anal tube ; *c*, cicatrix ; *f*, flagellate seta ; *fl*, foreleg ; *hl*, hind leg ; *hs*, hair-like seta ; *mp*, multilocular pore ; *mtp*, multilocular tubular pore ; *n*, nodulate seta ; *pp*, polygonal pore ; *sar*, sclerotised anal ring ; *sm*, simple micropore ; *ss*, spiniform seta ; *su*, subulate seta ; *ts*, thoracic spiracle. Scale line, 1 mm.

36-48 μm long, few scattered on head and thorax or just on derm around intersegmental lines, sometimes very few scattered over entire abdomen or just on derm around intersegmental lines, few to many scattered or sometimes in discrete clusters on derm marginally and segmentally at least on abdominal segments V-IX. Spiniform setae, 17-29 μm long, numerous, scattered over entire surface, predominant setal type ; setae medially on posterior abdominal segments IV-IX usually longer and less robust. Flagellate setae, 50-68 μm long, few scattered over entire surface, many around genital opening. Hair-like setae, 73-172 μm long, few, scattered over entire surface. Multilocular pores, 9-12 μm in diameter, with 3 circular central loculi and 3 elliptical peripheral loculi, numerous and scattered on head, thorax and abdominal segment I, few scattered medially on abdominal segments II-III and marginally on segments II-IX ; pores with 4 circular central loculi and 4 elliptical peripheral loculi, and with 3 circular central loculi and 5-7 elliptical peripheral loculi, very rare. Multilocular pores, 15-17 μm in diameter, with an elliptical or 3-4 circular central loculi and 7-9 elliptical peripheral loculi, numerous medially on abdominal segments IV-IX. Multilocular tubular pores, 17-18 μm in diameter, with 3-5 reniform subcentral loculi and 7-9 elliptical peripheral loculi, in broad bands across medial areas of abdominal segments II-V, submarginally on abdominal segments II-IX.

Notes : the distribution of the ventral subulate setae is very variable within the species. This inconsistency is observed not only between specimens collected from different localities, but also between specimens from the same locality. The specimens from the ' Amieu Pass Cascade ' locality have a somewhat constant setal distribution. Here, a few subulate setae are scattered on the head and thorax especially on the derm around intersegmental lines, but they are rare on the abdomen and marginally are concentrated in indiscrete segmental clusters which are most dense on abdominal segments V-IX. The subulate setae in specimens from the ' Ponerihouen ' locality are rare on the head and thorax and mainly observed in the intersegmental regions, and marginally they are present in discrete segmental clusters, these varying in size, on abdominal segments V-IX and are absent from the rest of the margin. The nodulate setae, however, are more numerous ventrally on specimens from the ' Ponerihouen ' locality and do not show the distributional differences observed in subulate setae. The ventral spiniform setae in specimens from the ' Amieu Pass Cascade ' locality are generally longer than those present in their counterparts. The specimens listed under ' *Other material examined* ' resemble the specimens from the ' Amieu Pass Cascade ' locality in the features discussed above. Despite the above differences, all the above mentioned specimens are considered to represent one species because they share a similar distribution of cicatrices and possess nodulate and subulate setae.

The first, second and third instar nymphs listed under ' Other material examined ' cannot be identified definitely as *T. guerini* but have been placed tentatively in *T. guerini*, because the second and third instar nymphs resemble the adult female of *T. guerini* in the distribution of cicatrices and subulate setae. The first instar specimen has the same collection data as the second instar and resembles the other immature stages in the structure and distribution of subulate setae.

Material examined for species description (these specimens were used by Miller for his redescription of *T. guerini*) : **neotype** (here designated) : NEW CALEDONIA, 1 ♀ : Ponerihouen, 6.X.69, on *Anona squamosa* (COCHEREAU) (MNHN). 3 ♀ : Amieu Pass Cascade, 20.XII.1967, on wild rainy forest tree (COCHEREAU) (ANIC, originally from USNM ; BMNH). 4 ♀ : Ponerihouen, 6.X.69, on *Anona squamosa* (COCHEREAU) (MNHN, USNM).

Other material examined : NEW CALEDONIA, 1 ♀ : Col d'Amieu, 650 m, 21.III.1968, ex *Calophyllum* (GRESSITT) (BPBM). 1 ♀ : (COHIC) (MNHN). 1 ♀ : 1950 (COHIC) (MNHN). 1 1st instar : Ouegoa, 30.IV.1958, on Niaouli (COHIC) (MNHN). 1 2nd instar : Ouegoa, May 1958, on Niaouli (COHIC) (MNHN). 3 ♀ (3rd instar) : Ouegoa, *Melaleuca* sp. (COHIC) (MNHN).

Tessarobelus immaturus n. sp.

(fig. 2)

Descriptinn of adult female (based on 3 ♀) : slide-mounted specimens elongate, elliptical, 7.0-

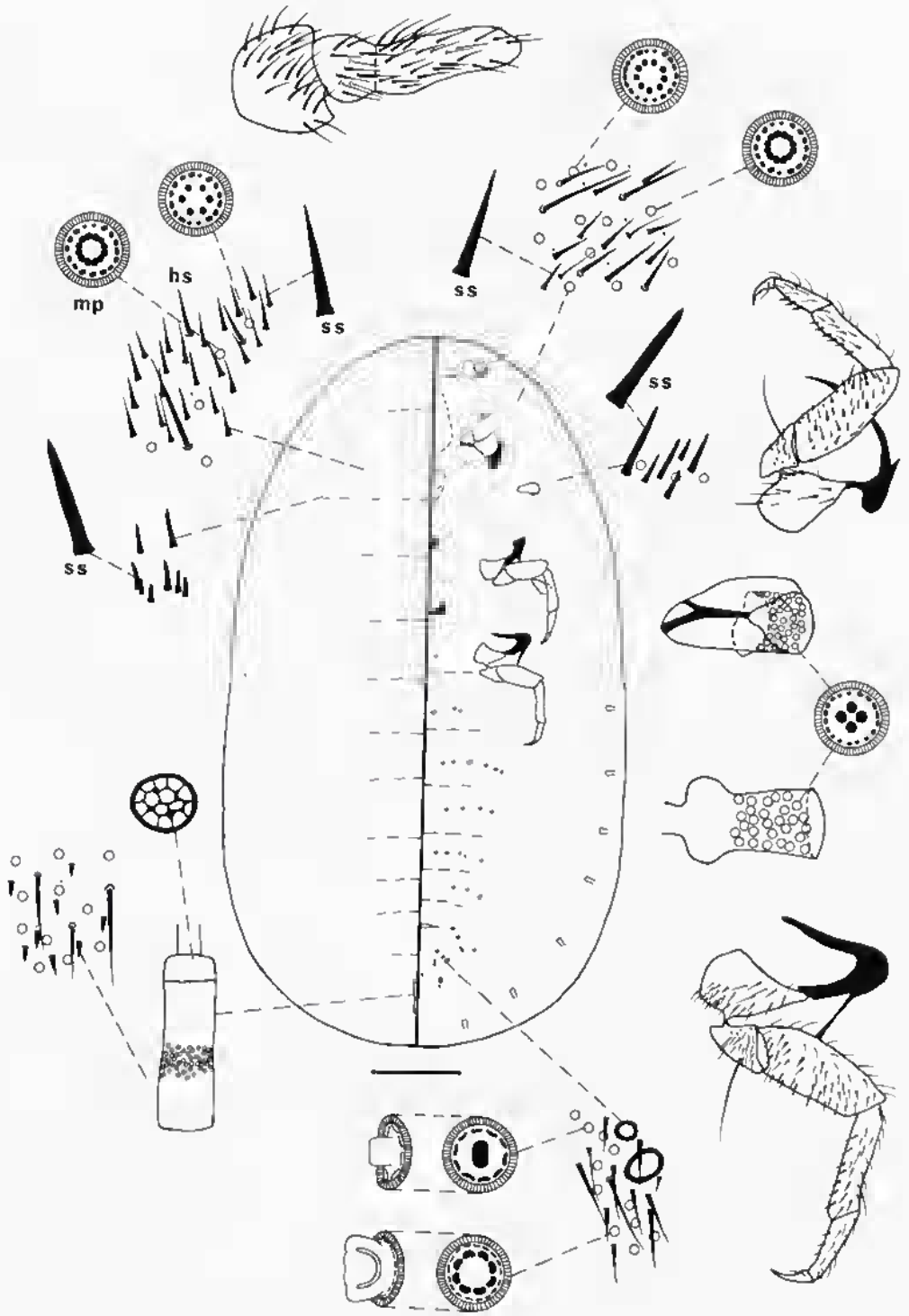

FIG. 2. — Adult female of *Tessarobelus immaturus* n. sp. *hs*, hair-like seta ; *mp*, multilocular pore ; *ss*, spiniform seta. Scale line, 1 mm.

8.9 mm long, 4.0-4.9 mm wide. Antenna 3 segmented, 590-670 μm long; apical segment (third segment) elongate, 305-370 μm long, 125-135 μm wide. Eyes of maximum diameter 110-130 μm. Clypeolabral shield 120 μm long. Labium 480-490 μm long. Hind legs 1780-1975 μm long. Mesothoracic spiracles plus peritremes 240-270 μm long, 110-120 μm wide; metathoracic spiracles plus peritremes 260-290 μm long, 100-125 μm wide. Atrium of abdominal spiracles 70-89 μm wide. Multilocular pores present in atrium of abdominal and thoracic spiracles; each pore with 3-4 circular central loculi and about 18 peripheral loculi. Anal tube 510-520 μm long; inner sclerotised ring of polygonal pores 160 μm wide. Ventral cicatrices 26-29 μm long, 25-28 μm wide, in transverse rows generally on abdominal segments III-VI (sometimes cicatrices present on segments I and II), and in rows following lines of segmentation on abdominal segments VII-IX (cicatrices generally absent medially on each segment).

Dorsum. Clavate setae absent. Nodulate setae absent. Subulate setae absent. Spiniform setae, 38-53 μm long, numerous, scattered over entire surface; setae on derm around intersegmental lines of desclerotisation have a robust apical part with a rounded to slightly acute apex. Flagellate setae, 49-73 μm long, few scattered over entire surface. Hair-like setae, 78-101 μm long, few, scattered. Multilocular pores, about 10 μm in diameter, with 6-12 circular central loculi and about 16-20 peripheral loculi, few, scattered over entire surface, pores sometimes completely absent on certain regions of derm usually medially across each segment. Trilocular tubular pores absent.

Venter. Clavate setae absent. Nodulate setae absent. Subulate setae absent. Spiniform setae, 53-74 μm long, numerous, scattered over entire surface; setae medially on posterior abdominal segments V-IX usually longer and less robust, setae on derm around intersegmental lines of desclerotisation have a robust apical part with a rounded to slightly acute apex. Flagellate setae, 58-69 μm long, few scattered over entire surface, many on derm around genital opening. Hair-like setae, 79-109 μm long, few, scattered. Multilocular pores, 11-12 μm in diameter, with 6-12 subcentral loculi and about 16-20 peripheral loculi, numerous on head and thorax, few on abdominal segments I-III, very few submarginally usually on abdominal segments IV-V, absent on abdominal segments VI-IX. Multilocular pores, 10-11 μm in diameter, with an elliptical or sometimes triangular central loculus and about 10 elliptical peripheral loculi, numerous, medially on abdominal segments VI-IX. Multilocular tubular pores, 17-19 μm in diameter, with 3-11 reniform subcentral loculi and about 18 peripheral loculi, few scattered in 1-2 rows on abdominal segment II, numerous in broad bands across medial areas of abdominal segments III-VI and submarginally on abdominal segments IV-IX. Trilocular tubular pores absent.

Notes : the antennae of both the adult female and the third instar female nymph are 3 segmented with the apical segment formed by the fusion of a number of segments.

Etymology : the specific name is a Latin adjective of ' premature ', describing the condition of the antenna in the adult female.

Type material : holotype ♀ : NEW CALEDONIA, Col d'Amieu, 21.III.1968, in ants' nest at leaf base, palm (MAA) (BPBM). Paratypes, 2 ♀ : same data as holotype (BPBM, MNHN).

Other material examined : 1 3rd instar ♀ : same data as holotype (BPBM).

Tessarobelus inusitatus n. sp.
(fig. 3)

Description of adult female (based on 9 ♀) : slide-mounted specimens elongate, elliptical, 5.2-8.7 mm long, 2.8-5.0 mm wide. Antenna 7-8 segmented, 930-1110 μm long; third segment 150-270 μm long; apical segment elongate 150-270 μm long, 70-90 μm wide. Eyes of maximum diameter 120-155 μm. Clypeolabral shield 700-790 μm long. Labium 405-430 μm long. Hind legs 2085-2635 μm long. Mesothoracic spiracles plus peritremes 220-315 μm long, 130-175 μm wide; metathoracic spiracles plus peritremes 250-310 μm long, 125-160 μm wide. Atrium of abdominal spiracles 46-56 μm wide. Multilocular pores present in atrium of abdominal and thoracic spiracles; each pore with an elliptical central loculus and about 11 peripheral loculi. Anal tube 48-70 μm long; inner sclerotised ring of poly-

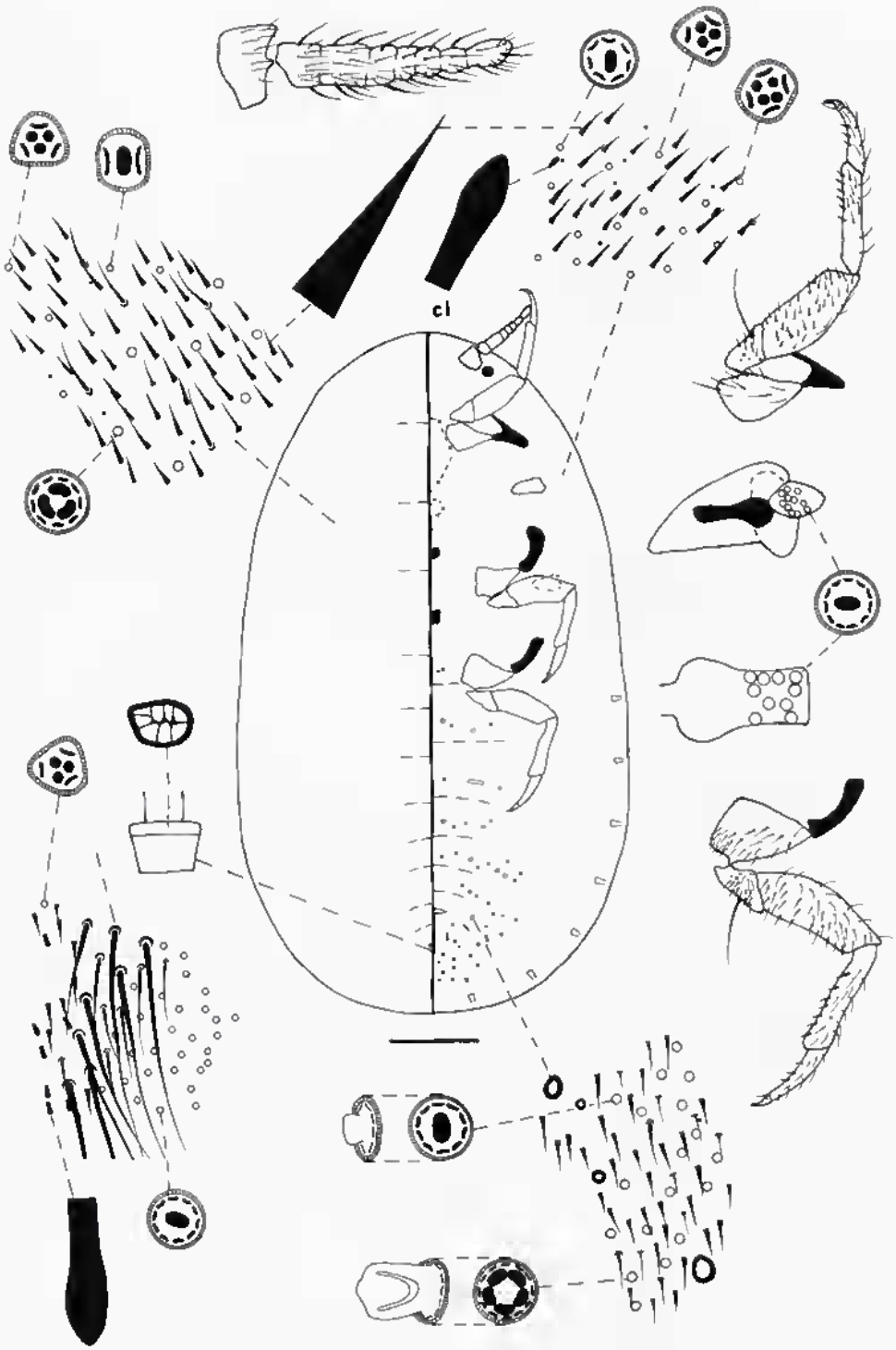

FIG. 3 Adult female of *Tessarobelus inusitatus* n. sp. *cl*, clavate seta. Scale line, 1 mm.

gonal pores 135-150 μm wide. Ventral cicatrices 29-34 μm long, 28-32 μm wide, in transverse rows generally on abdominal segments I-V (sometimes absent on segment 1 ; in some specimens cicatrices absent medially on some abdominal segments), and rows following lines of segmentation on abdominal segments VI-IX, absent medially on segments VI-IX.

Dorsum. Clavate setae 18-19 μm long, few on derm around anal opening on abdominal segments VII-IX. Nodulate setae absent. Subulate setae absent. Spiniform setae, 35-40 μm long, numerous, scattered over entire surface, predominant setal type. Flagellate setae, 55-64 μm long, very few scattered over entire surface. Hair-like setae, 126-133 μm long, few scattered, many setae in a dense ring on derm around anal opening. Multilocular pores, 8-9 μm in diameter, of three types : with an elliptical central loculus and 2 elliptical peripheral loculi, and with 3 circular central loculi and 3 elliptical peripheral loculi, both these types numerous, scattered over entire surface ; third type with an elliptical central loculus and about 10 elliptical peripheral loculi on derm surrounding anal opening. Multilocular tubular pores, 17-18 μm in diameter, with 2-6 reniform subcentral loculi and 9-14 peripheral loculi, many in broad transverse bands medially across each body segment, absent on derm medially on segments VII-IX. Trilocular tubular pores absent.

Venter. Clavate setae 20-27 μm long, few, scattered submarginally on thorax on derm lateral to each thoracic spiracle. Nodulate setae absent. Subulate setae absent. Spiniform setae, 40-50 μm long, numerous, scattered over entire surface, predominant setal type, setae medially on posterior abdominal segments V-IX usually less robust. Flagellate setae, 49-64 μm long, few scattered over entire surface, many on derm around genital opening. Hair-like setae, 117-173 μm long, few, scattered over entire surface. Multilocular pores, 8-9 μm in diameter, with 3 circular central loculi and 3-9 peripheral loculi, and with 4 circular central loculi and 4-6 peripheral loculi (pores with an elliptical central loculus and about 7 elliptical peripheral loculi rare), numerous scattered on head and thorax, few scattered on abdominal segments I-III, and very few submarginally on segments IV-IX. Multilocular pores, about 16 μm in diameter, with an elliptical central loculus and about 10 elliptical peripheral loculi, medial to intermediate in distribution on abdomen, few scattered on abdominal segments IV-V, numerous on abdominal segments VI-IX. Multilocular tubular pores, 16-18 μm in diameter, with 2-6 reniform subcentral loculi and 9-14 peripheral loculi, many in broad bands across head, thoracic segments I-III and abdominal segments I-V (absent to rare on derm medially on thorax), numerous submarginally on abdominal segments IV-IX, absent medially on segments VI-IX. Trilocular pores absent.

Etymology : The specific name is the Latin '*inusitatus*', meaning 'extraordinary', and refers to the distribution of multilocular tubular pores.

Type material : holotype ♀ : New Caledonia, Rivière des Lacs, 1.III.1987, *Tristaniopsis guillainii* (McKee) (MNHN). Paratypes : 6 ♀ : same data as holotype (BPBM, MNHN). 2 ♀ : Mts Koghis, 11.XII.1987, on Niaouli (MNHN).

Tessarobelus ordinarius n. sp.

(fig. 4)

Description of adult female (based on 3 ♀) : slide-mounted specimens elongate, elliptical, 9.2-10.7 mm long, 4.6-5.9 mm wide. Antenna 7 segmented, 830-1130 μm long ; third segment 170-250 μm long ; apical segment elongate 170-245 μm long, 90-115 μm wide. Eyes of maximum diameter 145-195 μm. Clypeolabral shield 830-965 μm long. Labium 380 μm long. Hind legs 2410-2915 μm long. Mesothoracic spiracles plus peritremes 250-360 μm long, 120-170 μm wide ; metathoracic spiracles plus peritremes 270-365 μm long, 140-195 μm wide. Atrium of abdominal spiracles 59-90 μm wide. Multilocular pores present in atrium of abdominal and thoracic spiracles ; each pore with an elliptical central loculus and about 16 peripheral loculi. Anal tube 230-275 μm long ; inner sclerotised ring of polygonal pores 140-165 μm wide. Ventral cicatrices 23-32 μm long, 22-28 μm wide, in transverse rows on abdominal segments II-VI, and in rows following lines of segmentation on abdominal segments VI-IX.

Dorsum. Clavate setae absent. Nodulate setae absent. Subulate setae absent. Spiniform setae, 23-28 μm long, numerous, scattered over entire surface, predominant setal type. Flagellate setae,

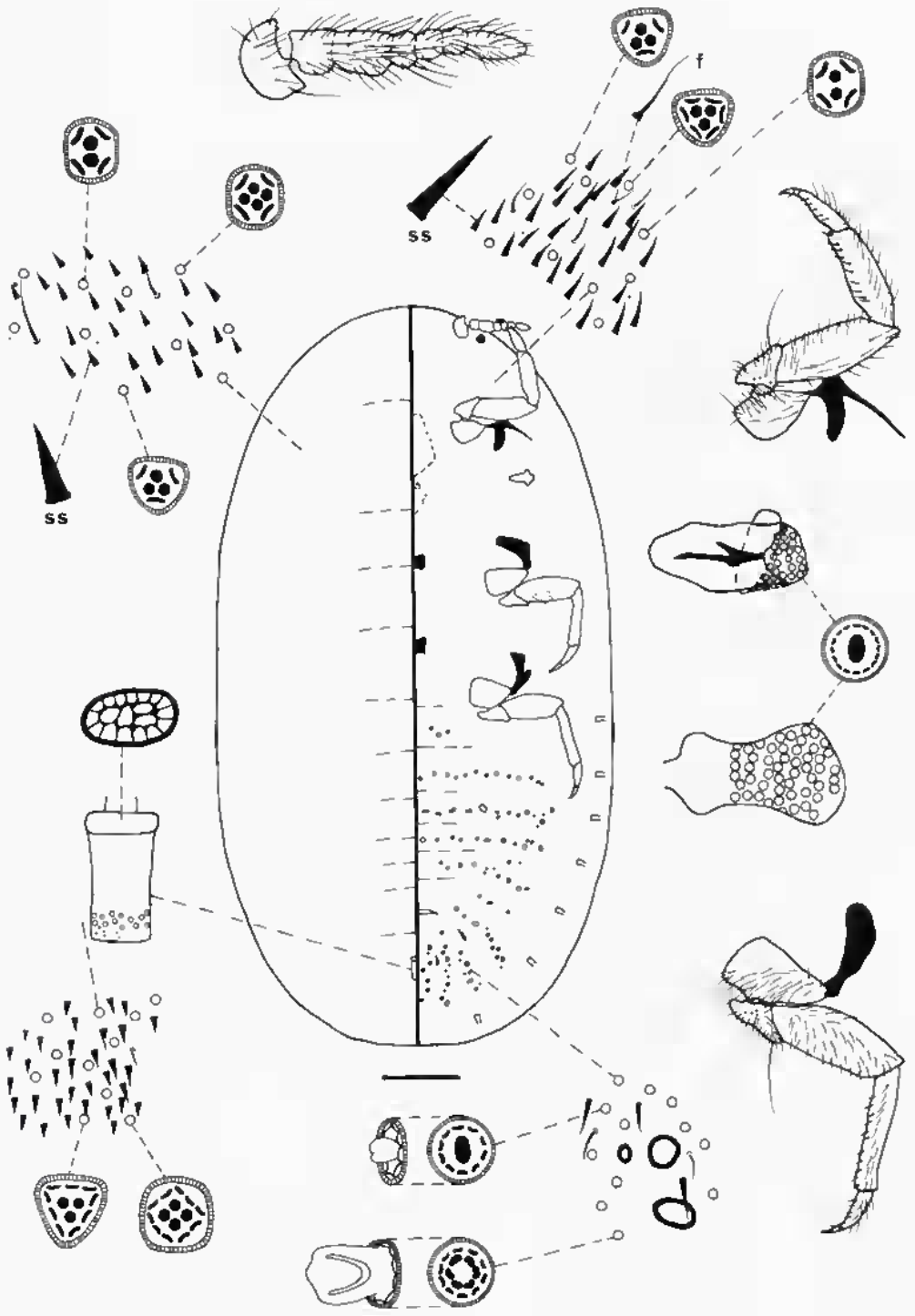

FIG. 4. Adult female of *Tessarobelus ordinarius* n. sp. *f*, flagellate seta ; *ss* spiniform seta. Scale line, 1 mm.

19-21 μm long, very few, scattered over entire surface. Hair-like setae, 48-88 μm long, few, scattered. Multilocular pores, about 9 μm in diameter, with 3 circular central loculi and 3 elliptical peripheral loculi and with 2 or 4 circular central loculi and 4 elliptical peripheral loculi, numerous, scattered over entire surface. Trilocular tubular pores absent.

Venter. Clavate setae absent. Nodulate setae absent. Subulate setae absent. Spiniform setae, 42-46 μm long, numerous, scattered over entire surface; setae on abdomen longer and less robust. Flagellate setae, 23-42 μm long, few scattered over entire surface, many on derm around genital opening. Hair-like setae, 81-94 μm long, few, scattered. Multilocular pores, 11-13 μm in diameter, with 3 circular central loculi and 3-6 elliptical peripheral loculi and with 2 or 4 circular central loculi and 4-5 elliptical peripheral loculi, numerous on head and thorax, few on abdominal segments I-II, very few submarginal to marginal on abdominal segments III-IX. Multilocular pores, 14-16 μm in diameter, with an elliptical or triangular central loculus and 9-10 elliptical peripheral loculi, medial to intermediate in distribution on abdomen, few scattered on abdominal segments IV-V, numerous on abdominal segments VI-IX. Multilocular tubular pores, 17-18 μm in diameter, with 3-6 reniform subcentral loculi and 8-10 peripheral loculi, in broad bands across medial areas of abdominal segments I-V, submarginally on abdominal segments VI-IX. Trilocular tubular pores absent.

Etymology : the specific name is derived from the Latin '*ordo*', meaning 'of regular or usual manner', and refers to the overall morphology of the species.

Type material : holotype ♀ : NEW CALEDONIA, plaine des Lacs, 2.II.1963, ex *Casuarina* branches (KRAUSS) (BPBM). Paratypes : 2 ♀ : same data as holotype (BPBM, MNHN).

Tessarobelus perissoporosus n. sp.

(fig. 5)

Description of adult female (based on 6 ♀) : slide-mounted specimens elongate, elliptical, 13.3-17.6 mm long, 6.9-9.25 mm wide. Antenna 9 segmented, 2050-2413 μm long ; third segment 215-270 μm long ; apical segment elongate 330-370 μm long, 130-150 μm wide. Eyes of maximum diameter 240-320 μm. Clypeolabral shield 1150-1175 μm long. Labium 750-838 μm long, 500-513 μm wide. Hind legs 5100-5513 μm long. Mesothoracic spiracles plus peritremes 560-710 μm long, 455-660 μm wide ; metathoracic spiracles plus peritremes 540-840 μm long, 585-700 μm wide. Atrium of abdominal spiracles 106-124 μm wide. Multilocular pores present in atrium of abdominal and thoracic spiracles ; each pore with either an elliptical central loculus or 3-4 circular central loculi and about 11-13 peripheral loculi. Anal tube 455-500 μm long ; inner sclerotised ring of polygonal pores 275-295 μm wide. Ventral cicatrices 42-62 μm long, 38-55 μm wide, in transverse rows on abdominal segments II-VI, and in rows following lines of segmentation on abdominal segments VI-IX.

Dorsum. Clavate setae absent. Nodulate setae absent. Subulate setae, about 43 μm long, few scattered over entire surface except absent on derm around intersegmental lines. Spiniform setae, 83-86 μm long, numerous, scattered over entire surface, predominant setal type. Spiniform setae on derm around the region of intersegmental lines become progressively slender apically, some becoming hair-like apically like flagellate setae. Flagellate setae, 65-73 μm long, few scattered over entire surface. Hair-like setae, 151-169 μm long, few, scattered. Multilocular pores, about 16-18 μm in diameter, with 3-5 circular central loculi and 7-11 elliptical peripheral loculi, numerous, scattered over entire surface (very dense compared to other species). Trilocular, tetralocular and pentalocular tubular pores, about 17-18 μm in diameter, numerous interspersed with multilocular pores, in broad segmental bands medial to intermediate and in submarginal segmental clusters extending up to the margin (somewhat continuous with marginal clusters drawn ventrally).

Venter. Clavate setae absent. Nodulate setae absent. Subulate setae, 38-44 μm long, numerous in segmental marginal clusters on derm associated with trilocular tubular pores, few scattered submarginal to marginal on head and thorax (derm lateral to legs), rare to very rare on abdominal segments I-VI. Spiniform setae, 82-106 μm long, numerous, scattered over entire surface, except rare medially on abdominal seg-

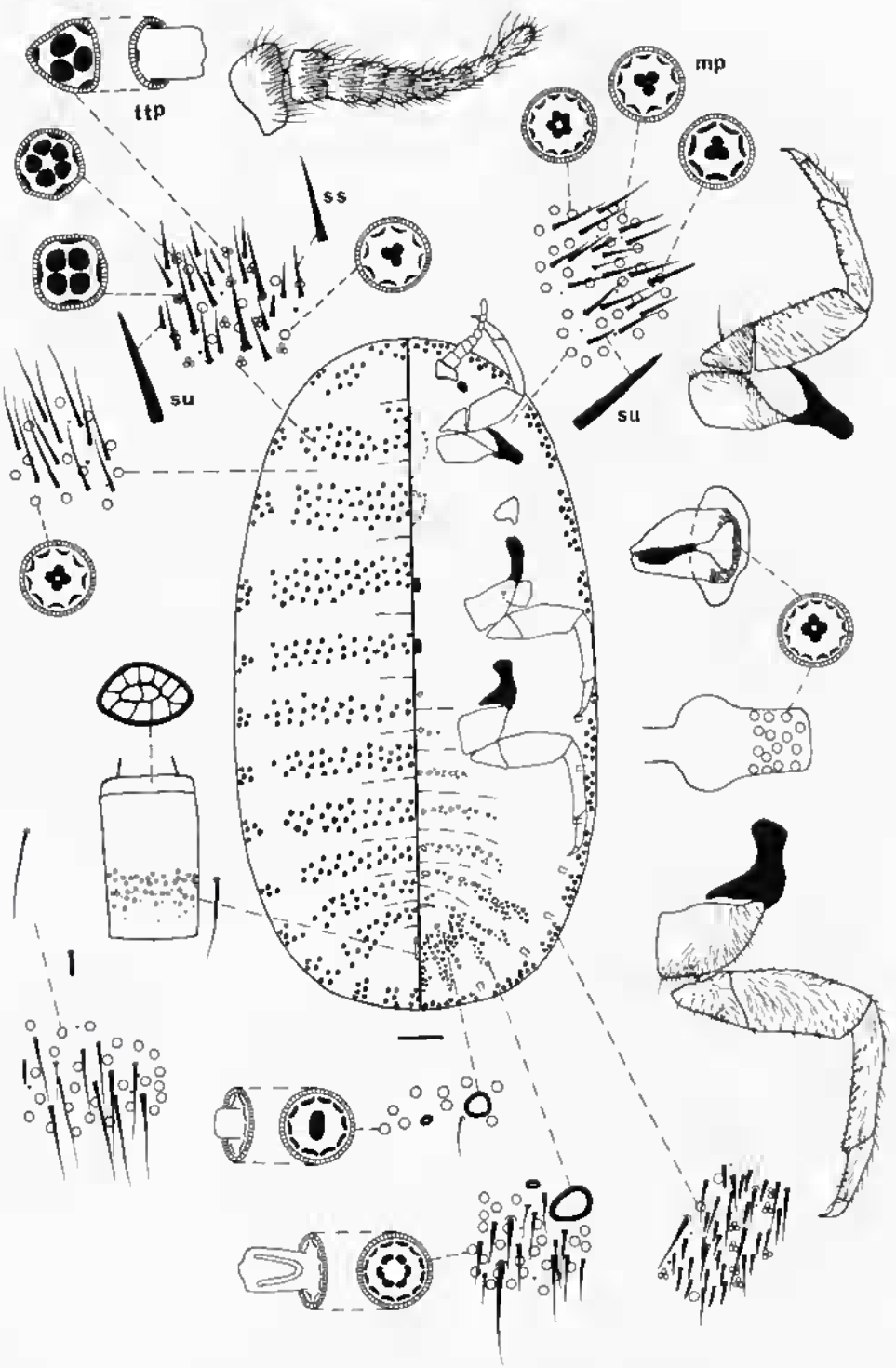

FIG. 5. Adult female of *Tessarobelus perrysoporosus* n. sp. *mp*, multilocular pore ; *ss*, spiniform seta ; *su*, subulate seta ; *ttp*, trilocular tubular pore. Scale line, 1 mm.

ments IV-IX. Flagellate setae, 38-68 μm long, few scattered over entire surface, many on derm around genital opening. Hair-like setae, 142-173 μm long, few, scattered. Multilocular pores, 16-21 μm in diameter, with 3-5 circular central loculi and 7-13 elliptical peripheral loculi, numerous on head and thorax, many on abdominal segments I-IV, few submarginal to marginal on abdominal segments V-IX. Multilocular pores, 17-18 μm in diameter, with an elliptical or triangular central loculus and about 10 peripheral loculi, medial to intermediate in distribution, on abdominal segments IV-IX. Multilocular tubular pores, 20-22 μm in diameter, with 3-5 reniform subcentral loculi and 8-14 peripheral loculi, in broad bands across medial areas of abdominal segments I-V, medial to marginal on abdominal segments IV-IX. Trilocular, tetralocular and pentalocular tubular pores, about 18 μm in diameter, in segmental marginal clusters.

Etymology : the specific name is derived from the Greek ' perissos ', meaning ' beyond the regular number or size ' and refers to the large size and dense distribution of all pore types.

Type material : holotype ♀ : NEW CALEDONIA, 16.II.1984, ex wild plant (MUNIAPPAN) (USNM). Paratypes : 4 ♀ : same data as holotype (USNM). 1 ♀ : Mts Koghis, 17.II.1984 (MADDISON) (MNHN).

Genus *INSULOCOCCUS* n. g.

Type species : *Insulococcus magnoporus* n. sp.

Generic description of adult female : slide-mounted specimens elongate, elliptical, broadened posteriorly. Antenna 8 segmented, basal segment largest, apical elongate ; hair-like setae present, number per segment variable. Eye spots circular to triangular, near antennal bases. Labium conical, 3 segmented : basal segment ring-like represented hy a narrow sclerotised band ; medial segment hroadest ; apical segment conical. Legs : each trochanter with 4 translucent pustules on each face ; tarsal claw with 1 pair of apically acute digitules shorter than claw length. Multilocular pores present inside atrium of abdominal spiracles and on derm outside thoracic spiracular openings. Dorsal anal tube short distance from apex of abdomen, with a sclerotised band of polygonal pores internally distal to external opening, and a ring of multilocular pores and short spines inside tube proximal to the external opening. Cicatrices circular to slightly elliptical, on venter only, on posterior abdominal segments VI-IX.

Dorsum. Clavate setae absent. Subulate setae absent. Spiniform setae absent. Flagellate setae numerous, scattered over entire surface, predominant setal type. Hair-like setae few, scattered over entire surface. Multilocular pores, with an elliptical central loculus and 4-6 triangular peripheral loculi, numerous, scattered over entire surface ; multilocular pores with 6-7 peripheral loculi, few, scattered. Trilocular tubular pores absent.

Venter. Clavate setae absent. Subulate setae absent. Spiniform setae absent. Flagellate setae numerous scattered over entire surface. Hair-like setae few, scattered. Multilocular pores, with an elliptical to rhomboid central loculus and 6-8 triangular peripheral loculi, scattered over entire surface. Multilocular pores, with an elliptical, triangular or rhomboid central loculus and about 10 elliptical peripheral loculi, numerous medially on abdominal segments IV-IX. Multilocular tubular pores present in transverse bands medially on abdominal segments I-V and submarginally to marginally on abdominal segments II-IX. Trilocular tubular pores absent.

Etymology : the generic name is derived from the Latin ' insula ' meaning ' island '.

Insulococcus magnoporus n. sp.

(fig. 6)

Description of adult female (based on 1 ♀) : slide-mounted specimen elongate, elliptical, 7.9 mm long, 4.2 mm wide. Antenna 8 segmented, 1650-1655 μm long ; apical segment elongate 310-330 μm long, 110 μm wide. Eyes of maximum diameter 175-190 μm. Clypeolabral shield 920 μm long. Labium 425 μm long. Hind legs 3460-3465 μm long. Mesothoracic spiracles plus peritremes 350-355 μm long, 280-310 μm wide ; metathoracic spiracles plus peritremes 350-440 μm long, 290-350 μm wide. Atrium of abdominal spiracles 59 μm wide. Multilocular pores present on derm outside thoracic spiracular openings and inside atrium of abdominal spiracles ; each pore with an elliptical to somewhat rhomboid

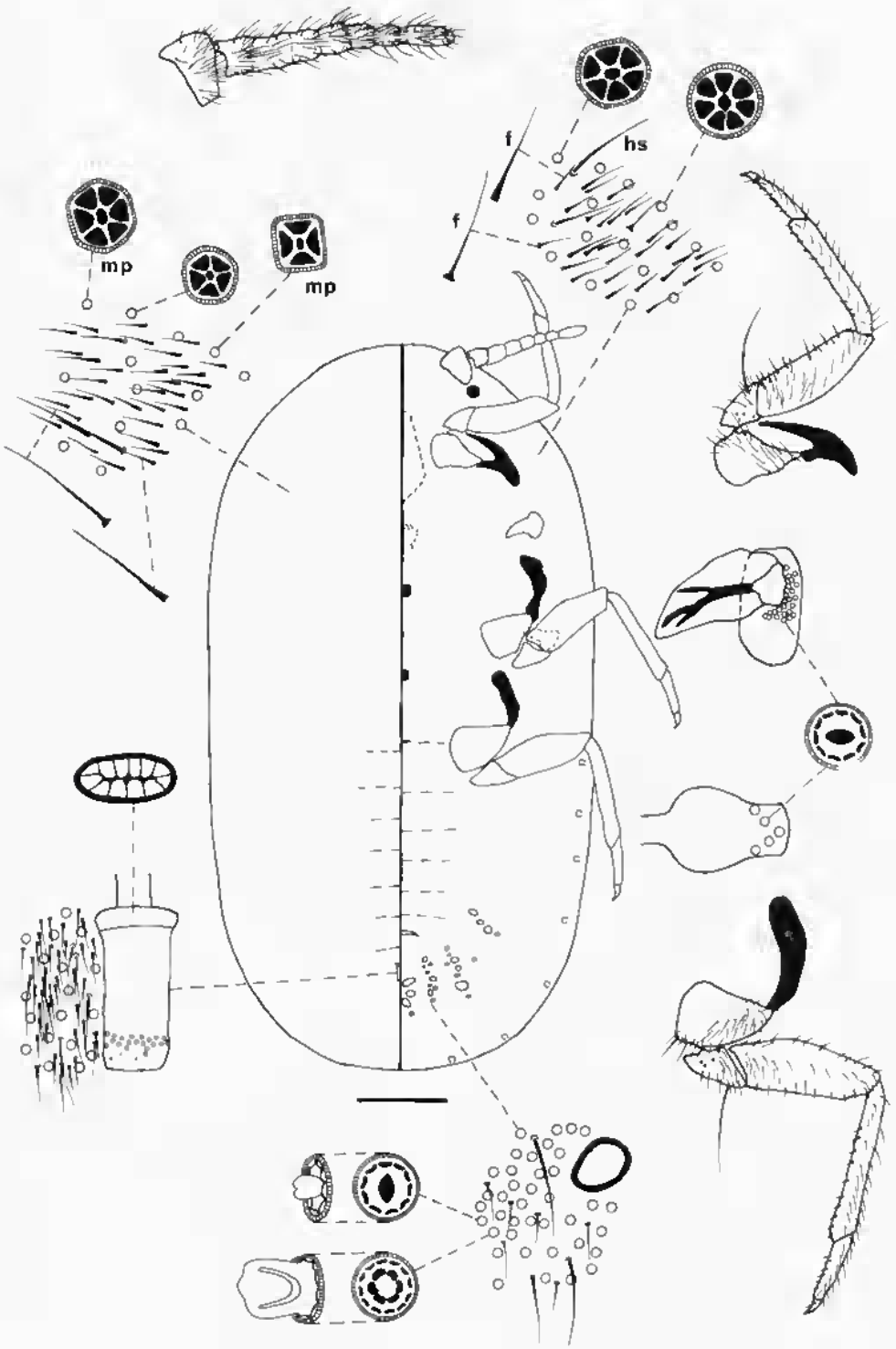

FIG. 6. — Adult female of *Insulococcus magnoporus* n. g. n. sp. *f*, flagellate seta ; *hs*, hair-like seta ; *mp*, multilocular pore. Scale line, 1 mm.

central loculus and 7-10 peripheral loculi. Anal tube 210 μm long; inner sclerotised ring of polygonal pores 155 μm wide. Ventral cicatrices 18-113 μm long, 17-78 μm wide, in short rows intermediate in position on abdominal segments VI-IX.

Dorsum. Clavate setae absent. Subulate setae absent. Spiniform setae absent. Flagellate setae 33 μm long, numerous, scattered over entire surface, predominant setal type. Hair-like setae, 30-134 μm long, few, scattered over entire surface. Multilocular pores, 12 μm in diameter, with an elliptical central loculus and 4-6 triangular peripheral loculi, numerous, scattered over entire surface; multilocular pores with 6-7 peripheral loculi slightly larger in diameter, few, scattered. Trilocular tubular pores absent.

Venter. Clavate setae absent. Subulate setae absent. Spiniform setae absent. Flagellate setae, 53 μm long, numerous scattered over entire surface except rarer medially on abdominal segments III-IX. Hair-like setae, 44-163 μm long, scattered. Multilocular pores, 15 μm in diameter, with an elliptical to rhomboid central loculus and 6-8 triangular peripheral loculi, scattered over entire surface, numerous and predominant pore type on head and thorax. Multilocular pores, 18 μm in diameter, with an elliptical, triangular or rhomboid central loculus and about 10 elliptical peripheral loculi, numerous, medial to intermediate in position on abdominal segments IV-IX. Multilocular tubular pores with 3-6 reniform subcentral loculi and 9-14 elliptical peripheral loculi, in transverse bands medially on abdominal segment I, medial to marginal across abdominal segments II-V and absent medially on segments VI-IX; bands of multilocular pores (with 6-8 triangular peripheral loculi) alternating with bands of multilocular tubular pores present submarginally to marginally on abdominal segments II-IX. Trilocular tubular pores absent.

Notes : larvae of a species of *Cryptochetum* Rondani (Diptera : Cryptochetidae), possibly *C. striatum* Thorpe, were observed inside the holotype. The known species of *Cryptochetum* are parasitoids of scale insects of the family Margarodidae (FERRAR, 1987). Larvae of *Cryptochetum* species have also been observed in other monophlebine margarodids of Australia (RILEY, 1889; GHESQUIÈRE, 1942) and New Guinea (BHATTI & GULLAN, 1990).

Etymology : the specific name is derived from the Latin '*magnus*' and '*porus*' meaning 'large' and 'pore' respectively, indicative of the very large peripheral loculi of the multilocular pores of this species.

Type material : holotype ♀ : LOYALTY ISLANDS, Lifu I., Wé, 16-18.II.1963 (YOSHIMOTO) (BPBM) (some parasitoids dissected from inside the female are mounted on a separate microscope slide and the rest are preserved in a vial). Paratype ♀ : NEW CALEDONIA, Sarraméa, 30.XI.1983, on *Eugenia jambos* (MATILE) (MNHN 9592).

ACKNOWLEDGEMENTS

I would like to thank Dr D. J. WILLIAMS (CABIIE) for arranging loan of Bernice P. Bishop Museum specimens, and Dr J. M. COX (BMNH), Dr D. R. MILLER (USDA) and Dr D. MATILE-FERRERO (MNHN) for arranging loans of BMNH, USNM and MNHN specimens respectively. I also extend my appreciation to Dr. MILLER for providing information on the specimens and characters of *Tessarobelus* that he used in his study, to Dr Ian NAUMANN for his assistance in locating obscure localities, and to E. PICARD and C. REID for translating the summary to French. The A.N.U. Photographic Service photographed the line drawings. I acknowledge the help of Dr P. J. GULLAN in reading the manuscript and the numerous discussions we had regarding the taxonomic status of *Tessarobelus* and Dr J. M. Cox for her comments on the manuscript. This study was conducted while the author held an A.N.U. Postgraduate Scholarship.

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